IoT Sensor Project (Smart Plant Sensors)

sddec21-08
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Mason Gil - Software
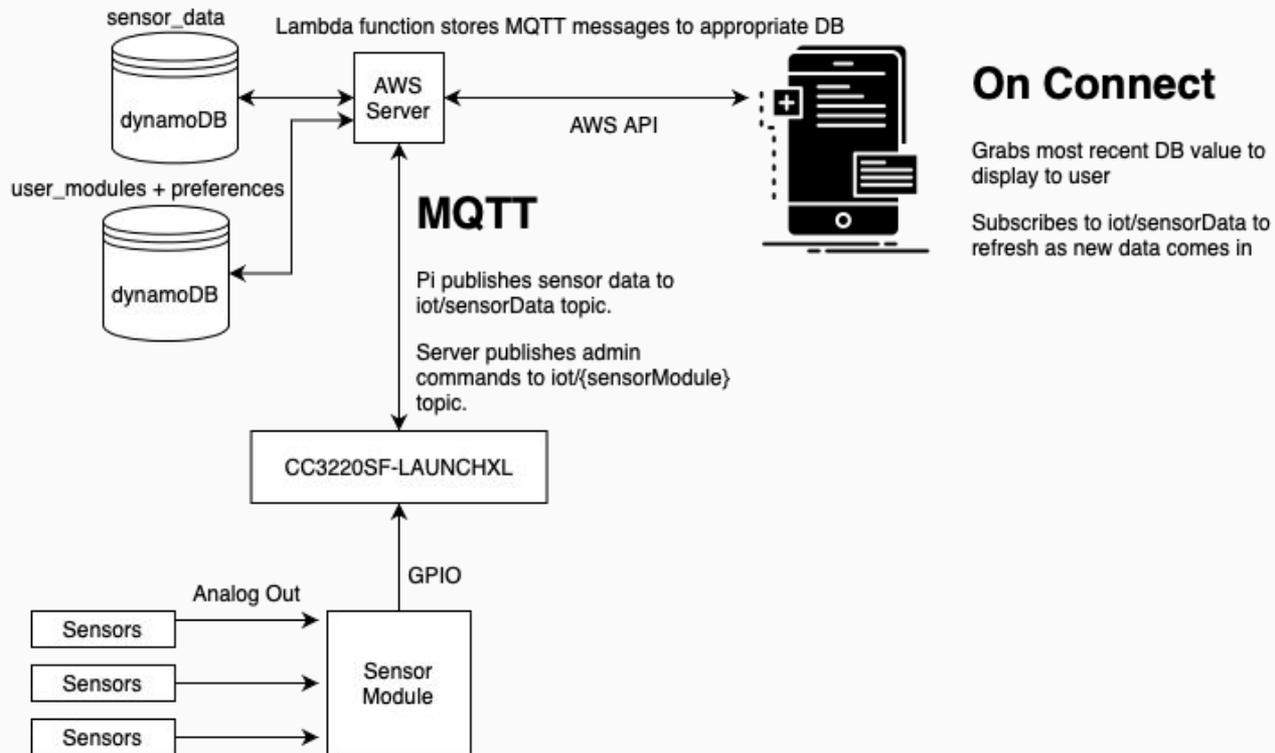Daniel Phalen - Hardware
Thomas Smeed - Hardware
Walter Gilbert - Software

Project Overview

- Initial Problem Statement
    - Very broad
    - Do a project with IoT sensors
- Proposed solution
    - Web-based interface that allows users to monitor the status of their plants remotely
    - Focus on modular design
    - Moisture sensors, temperature sensors

Overall System Diagram

Goals for the Semester

- Graph view for sensors
  - See how the temperature has been changing over time, watch moisture levels, etc.
- User preferences + alerts
  - Set up thresholds for sensor values and let user know when values are out of bounds
  - Visual indication on the board (simple LED to start)
- Daughter board and integration with gateway

Progress So Far

- AWS skeleton is finished
    - Gateway -> AWS -> frontend
    - Frontend -> AWS -> gateway
    - When gateway is publishing sensor values, sensor view on our web app updates appropriately
    - DynamoDB is set up, fills up as MQTT messages flow
    - Basic UI setup on AWS Amplify
- Hardware design on PCB is underway
- Base code for launchpad gateway is complete
    - Runs FreeRTOS
    - Uses MQTT for communication

PCB Design Feature

- Receives analog data from 16 sensors
- Uses 6 GPIO ports from TI launchpad
  - 2 for data
  - 4 for switch logic
- Modular pin header for sensors
- Powered by USB C
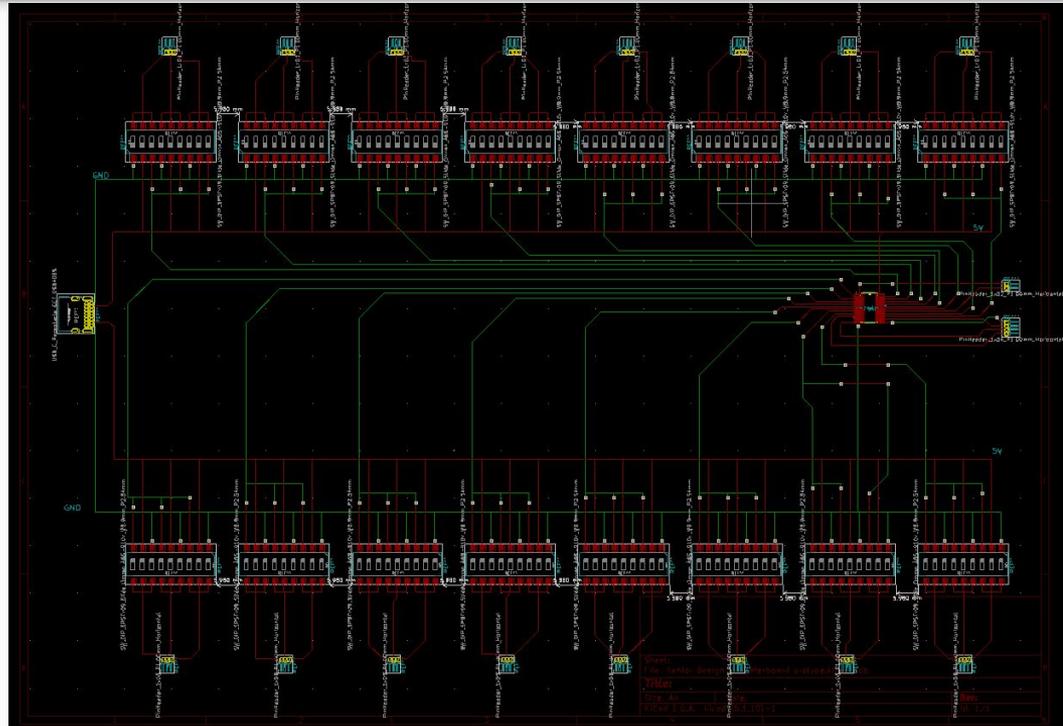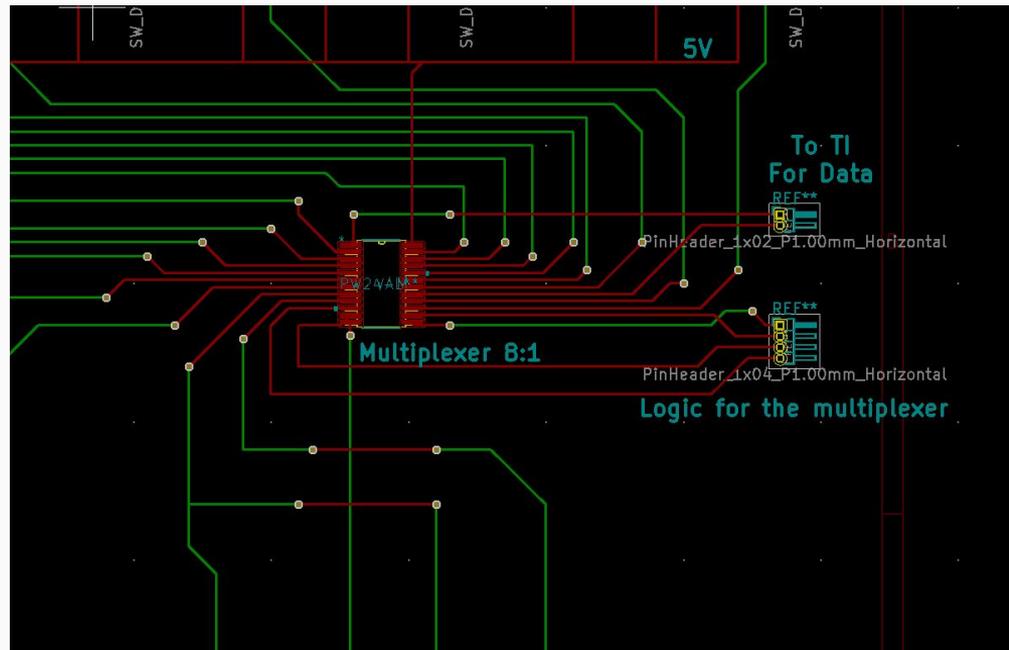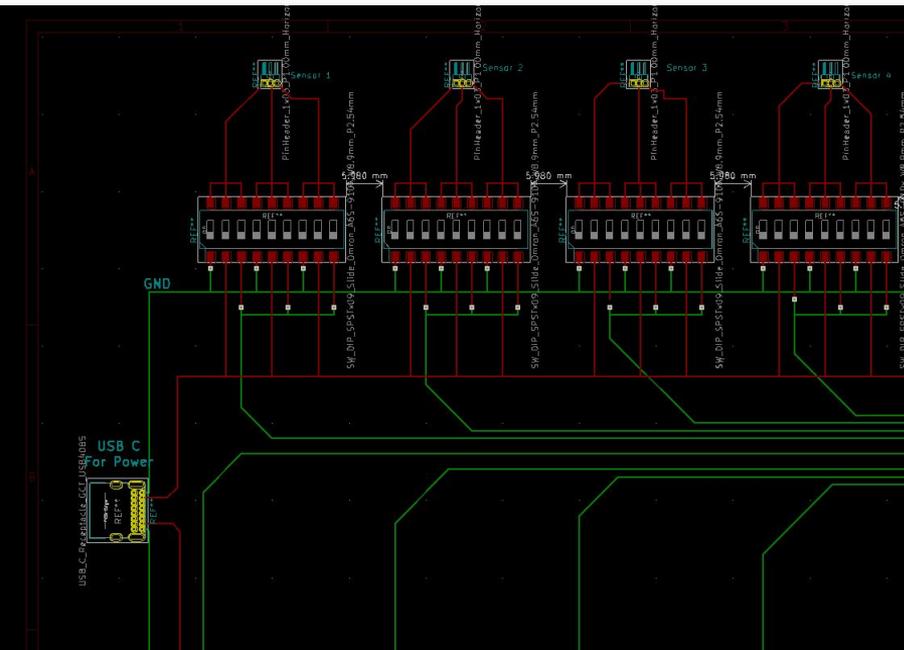
Website

- Built using Amplify
  - Easy to integrate with AWS
  - Provides authentication API we can use
- Sign In/Up Pages
  - Confirmation codes
- Home Page
  - Grabs all sensor modules belonging to your user
  - Looks at DynamoDB for last value on connect
  - Subscribes to MQTT topic for real time updates
- Planned/WIP Features
  - Graph View
  - Scheduling/Alerts
  - Modularity in sensor display

Home

TestModule
sddec21-08@iastate.edu

Temperature: 74 °F
Moisture: 45 %

GRAPH VIEW   SETTINGS

TestModule2
sddec21-08@iastate.edu

Temperature: 32 °F
Moisture: 20 %

GRAPH VIEW   SETTINGS

launchpad-gateway0
sddec21-08@iastate.edu

Temperature: 72 °F
Moisture: 46 %

GRAPH VIEW   SETTINGS

USER SETTINGS

SIGN OUT

Gateway to AWS

Device came up in Station mode
[WLAN EVENT] STA Connected to the AP: Buttery , BSSID: 80:b9:7a:86:f6:6
[NETAPP EVENT] IP acquired by the device

Device has connected to Buttery
Device IP Address is 192.168.4.74

9 8739 [iot_thread] [INFO][DEMO][8739] Successfully initialized the demo. Network type for the demo: 1

10 8739 [iot_thread] [INFO] Creating a TLS connection to a2s5ixoqotf7zk-ats.iot.us-east-2.amazonaws.com:8883.
11 9440 [iot_thread] [INFO] Creating an MQTT connection to a2s5ixoqotf7zk-ats.iot.us-east-2.amazonaws.com.
12 9924 [iot_thread] [INFO] Packet received. ReceivedBytes=2.
13 9924 [iot_thread] [INFO] CONNACK session present bit not set.
14 9924 [iot_thread] [INFO] Connection accepted.
15 7933 [iot_thread] [INFO] Received MQTT CONNACK successfully from broker.
16 7933 [iot_thread] [INFO] MQTT connection established with the broker.
17 7934 [iot_thread] [INFO] An MQTT connection is established with a2s5ixoqotf7zk-ats.iot.us-east-2.amazonaws.com.
18 7934 [iot_thread] [INFO] Publish to the MQTT topic iot/sensorData.
19 7946 [iot_thread] [INFO] SUBSCRIBE sent for topic iot/launchpad-gateway0/admin to broker.
20 8045 [iot_thread] [INFO] Packet received. ReceivedBytes=3.
21 8045 [iot_thread] [INFO] Subscribed to the topic iot/sensorData with maximum QoS 1.
22 9045 [iot_thread] [INFO] Publish to the MQTT topic iot/sensorData.
23 9046 [iot_thread] [INFO] Attempt to receive publish message from broker.
24 9357 [iot_thread] [INFO] Packet received. ReceivedBytes=2.
25 9357 [iot_thread] [INFO] Ack packet deserialized with result: MQTTSuccess.
26 9357 [iot_thread] [INFO] State record updated. New state=MQTTPublishDone.
27 9357 [iot_thread] [INFO] PUBACK received for packet Id 2.

Real time updates

launchpad-gateway0

sddec21-08@iastate.edu

Temperature: 72 °F
Moisture: 46 %

GRAPH VIEW **SETTINGS**

USER SETTINGS

SIGN OUT

Real time updates

AWS to Gateway

launchpad-gateway0
sddec21-08@iastate.edu

Temperature: 55 °F
Moisture: 53 %

📊 GRAPH VIEW   ⚙ SETTINGS

〔 ((•)) PING MODULE 〕

🌡 TOGGLE TEMPERATURE

💧 TOGGLE MOISTURE

31 10096 [iot_thread] [INFO] Incoming QoS : 0

32 10096 [iot_thread] [INFO] Incoming Publish Topic Name:
iot/launchpad-gateway0/admin matches subscribed topic.Incoming Publish
Message : {"id":"on"} (placehold message)
33 10099 [iot_thread] [INFO] Packet received. ReceivedBytes=41.
34 10099 [iot_thread] [INFO] De-serialized incoming PUBLISH packet:
DeserializerResult=MQTTSuccess.
35 10099 [iot_thread] [INFO] State record updated. New
state=MQTTPublishDone.
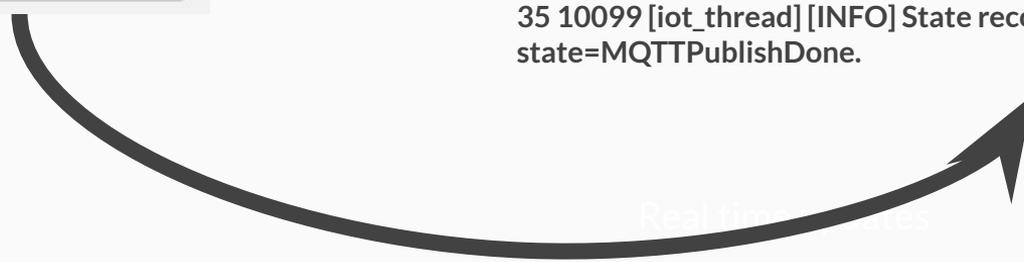
Real time updates

Challenges

- Planning out the firmware to read sensor data without the daughter board ready.
- AWS was quite involved to get setup with for beginners.
- Figuring out how to power a large number of sensors.